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(54) Title: MODULE FOR MOBILE TERMINALS			
(57) Abstract  The present invention relates to a system and a device to increase the capacity of a mobile terminal to execute user applications or handle execution environments for user applications. This is achieved by providing a mobile terminal including an interface device, at which said device is designed for reception of an expansion module, and an expansion module including at least one circuit for storing of data, at which said module also includes an interface designed for connection to the interface device of said mobile terminal, and at which a connected module together with the mobile terminal forms an integrated hardware platform.			

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MODULE FOR MOBILE TERMINALSField of the invention

The present invention relates to a system and a device to  
5 increase the capacity of a mobile terminal to execute user  
applications or manage executing environments for user  
applications.

Background of the invention

10 In the mobile telephones of today memory capacity and  
processing power constitute a large part of the cost for a  
mobile terminal. At mass production of mobile terminals, as  
for instance mobile telephones, the manufacturers in order  
to achieve maximum financial margins consequently equip the  
15 mobile terminals with as small memory capacity and as small  
processor capacity as possible.

The development in the field of mobile terminals, and  
especially mobile telephones, all the time is going towards  
more advanced and memory demanding applications. Also the  
20 execution environments of the applications are becoming  
more and more complex. Applications for storing of larger  
voice messages or text messages make greater demands for  
available storage capacity. Other new applications, which  
for instance can be multimedia applications including video  
25 coders and speech coders, or applications based on the  
lately established Wireless Application Protocol (WAP),  
require very high data processing capacities. This also  
applies to Java applications or Java applets which is  
executed by a so called Java machine, which in most cases  
30 are implemented in software. Before long, specific  
processors which are optimised for Java will occur on the  
market. For cost reasons, however, only certain more  
expensive mobile telephones will be equipped with this type  
of processors.

35 Mobile terminals of the future consequently will be  
demanding considerably larger memory storage, as well as

higher data processing capacity. Because different users will have different needs in form of different applications and execution environments, and these in their turn make different demands upon the capacity of the mobile terminal, the manufacturers before long will need to divide the production of a product in designs with high capacity and in designs with low capacity. To produce for instance a mobile telephone which is suitable to all needs will no longer be economically justifiable.

10

#### Summary of the invention

The purpose of the present invention is to provide a system and a device which makes it simple to adapt the capacity of a mobile terminal to solve the above stated problem.

15

One aim of the present invention consequently is to make it possible to, in a simple way, extend the capacity of a mobile terminal and manage resource demanding user applications.

20

Another aim is to make it possible to in a simple way extend the capacity of a mobile terminal and manage the resource demanding execution environments which are required for certain user applications.

25

Yet another aim is to increase the capacity of an originally resource-scanty mobile terminal to make possible execution of resource demanding Java applications or applications based on Wireless Application Protocol (WAP).

30

The above mentioned purposes and aims are achieved by a system and an expansion module according to what is defined in the enclosed patent claims.

35

According to a first aspect of the invention a system is provided to increase the capacity of a mobile terminal and to execute user applications and manage execution environments for user applications. The main components in said system consist of a mobile terminal, including one or more interface devices, at which each such device is

designed for reception of an expansion module, and an expansion module including at least one circuit for storing of data, at which said module also includes a physical and logic interface designed for connection to the interface  
5 device of said mobile terminal, and at which a connected module together with the mobile terminal constitute an integrated hardware platform.

According to a second aspect of the invention an expansion module is provided intended to increase the  
10 capacity of a mobile terminal to execute user applications or handle execution environments for user applications, at which said expansion module includes at least one circuit for storing of data, or a circuit for processing of data, and an interface designed for connection to a mobile  
15 terminal, and at which the module at connection to the mobile terminal expands the hardware platform of the mobile terminal.

The invention consequently is based on the knowledge of providing a capsule including hardware resources, in  
20 form of memory circuits and/or a processor, with an interface by means of which one in a simple way can connect the capsule to a mobile terminal. The capsule is connected in such a way that its hardware resources expand the existing hardware resources of the mobile terminal and  
25 creates an integrated hardware platform on which applications and application environments in form of, for instance, operating systems or Java machines can execute.

It should be understood that by hardware platform is meant all the hardware resources which are available for an  
30 application which executes on a mobile terminal, i.e. resources such as memory storage, processor power, communication ports, display, keypad, microphone and loudspeaker, and that the hardware resources which are expanded within the frame of this platform according to the  
35 present invention are the memory storage resources and the processor power resources.

Further, the term mobile terminal refers to, within the frame of this invention, a portable terminal in form of a telephone, a handportable computer or the like, by means of which a user or an application can communicate wirelessly.

One advantage of the present invention consequently is that a mobile terminal, or mobile telephone, can be manufactured with smallest possible memory and processor capacity for the most basic functions, such as common wireless telephony. On basis of demands of different users to have possibility to use different types of application programs, where different programs make different great demands of the capacity of the mobile terminal, the mobile terminal then can by means of an expansion module be optimised to be possible to use for a certain type of applications which require a certain capacity of the mobile terminal.

A user consequently only need to pay for the hardware he/she at the moment is needing, and can change between different expansion modules, which contribute with different degrees of capacity additions to the mobile terminal, at a rate which fits his/her wishes to utilise different application environments. A new service or application may quickly have a large number of users as these can keep their old mobile terminals and only need to upgrade them with new expansion modules. A system with expansion modules according to the invention therefore will be optimal from both the users and the service provider's perspective.

By, within the standard of WAP, defining the interface between the mobile terminal and the expansion module as an API (Application Programming Interface), the present invention will open the possibilities for a lot of new applications which can utilise the client-server concept which WAP is based on. The client part of the application



then can be hold in the expansion module and utilise said defined API.

In the present invention it is preferred that the hardware resources in said expansion module, or capsule, via the interface are connected to the internal addressing and data signals of the mobile terminal. A this a processor, irrespective of whether is in the mobile terminal or the expansion module, will be able to control the resources in the common hardware platform without any preceding form of communication between different units which, for instance, is the case when a mobile terminal and a portable computer are interconnected. In the same way it makes no difference if a memory circuit is located in the mobile terminal or in the expansion module, as such consideration need not to be taken because the circuit is connected to the common addressing and data signals of the hardware platform. The connection consequently resembles the connection of an expansion card to a computer, where the computer in this case corresponds to the mobile terminal, and the expansion card to the expansion module.

In addition to the genuine hardware resources within the hardware platform, all other functionality which is built up in the mobile terminal, such as set up of calls, call control and handling of SMS messages (Short Message Services), will of course be available to an application irrespective of where in the hardware platform the processor which executes the application is located.

According to one embodiment a memory circuit included in said expansion module includes in advance stored data. This data constitute either the whole of, or parts of, a user application or application environment in advance stored in the module. Another preferred utilisation of in advance stored data is that these for configuration of the hardware platform include a program routine for this purpose, and belonging configuration parameters. This configuration maps i.a. all the included components in the

hardware platform which are intended to be memory mapped on one to the hardware platform common address space.

These different types of in advanced stored data makes the handling at connection of expansion modules and start  
5 of new applications extremely simple by configuration and start being made automatically after the expansion module having been connected physically to the mobile terminal, i.e. the handling follows the principle "plug'n play".

Further advantages of, and aspects of, and  
10 characteristics, of the invention will be evident from the description below, by exemplified embodiments of them.

#### Brief description of the drawings

Exemplified embodiments of the present invention will  
15 be described below with reference to the enclosed drawings, where an element which is represented in more than one figure has the same reference designation, in which:

Figure 1 schematically shows a mobile telephone arranged to be included in a system according to the  
20 invention;

Figure 2 schematically shows an exemplified expansion module according to the invention; and

Figure 3 schematically shows an exemplified system in full according to the present invention.

25

#### Description of preferred embodiments

Figure 1 shows schematically a mobile telephone 10 designed to be included in a system according to the invention. The mobile telephone includes an interface  
30 device 20 designed for reception of an expansion module. Further, the mobile telephone includes a lot of components, i.a. a processor 30, a memory 31, and a number of I/O-related (Input/Output) circuits which commonly only have been indicated by a reference designation 32. The indicated  
35 circuits 32 include a lot of circuit hardware related to the I/O-functionality which typically exists in a



conventional mobile telephone; such circuits can be related to a keypad, a display, a loudspeaker, a microphone etc.

Via addressing and data signals 40, the processor 30 addresses and controls other hardware 31, 32, and  
5 reads/writes data from/to said other hardware. This flow of signals to, respective from, the in the mobile telephone included components are indicated by two-way arrows which symbolise both address and data buses. It is to the expert well known how these control and data signals are connected  
10 to the different components, and how the different components utilise these to achieve the functionality which exists in a conventional mobile telephone.

The main difference between a mobile telephone according to the present invention and a conventional  
15 mobile telephone is that the former includes an interface device 20. Further the mobile telephone according to the invention is characterised in that this interface device makes it possible to directly connect an external unit to the address and data buses 40 of the mobile terminal.  
20 Figure 1 shows how the address and data buses 40 are directly connected to the interface device 20. The upper address/data bus connection 40' is intended for connection of further processor power, and the lower address/data bus connection 40" is intended for connection for further  
25 memory capacity. A controllable switch 50 makes possible control of address respective data signals either to/from the mobile terminal's own processor, or to/from a connected processor. How the switch is controlled is determined on basis of which application or application environment which  
30 the mobile handles.

The location of the interface device 20 is only an exemplification; the interface device can of course be located at another suitable place. With a solution where the previously described expansion module is moulded  
35 together with the battery of the mobile terminal, the interface device can be located, for instance, on the

mobile terminal on such a place where it is hidden behind the battery.

Figure 2 shows schematically an expansion module 60 according to one embodiment of the present invention. The expansion module includes a DSP 70 (Digital Signal Processor), or some other type of in the market available processor, which processor preferably is considerably more powerful than the in Figure 1 indicated processor 30. The expansion module also includes a memory circuit 80 including both PROM-memory 81 (Programmable Read Only Memory), or other non-volatile memory, such as RAM-memory 82 (Random Access Memory).

Via communication paths 85', 85" the processor 70 and the memory 80 are connected to an interface 95. The interface 95 is designed for connection to a corresponding interface at a mobile terminal in such a way that the processor 70 at connection, via a communications path 85', and a connection point 90' is connected to the address and data bus of the mobile terminal; consequently communication path 85' will constitute a form of extension of the address and data bus of the mobile terminal. In a corresponding way the memory 80 will, via the communication path 85" and another connection point 90" in the interface 95, be connected to the address and data bus of the mobile terminal at connection to a corresponding connection point an interface arranged on the mobile terminal.

In said PROM-memory there are configuration data stored in advance intended to configure the hardware platform of a mobile terminal at connection of the expansion module to a mobile terminal. The PROM-memory also contains data in form of one in advance stored application specific initiating routine, which routine at connection of the expansion module to the mobile terminal is intended to initiate loading and storing of application software in the RAM-memory 82. The application software consist of, for instance, the client part of an application which follows

the WAP-standard, and the initiating routine is so designed that, at connection to the mobile terminal, this software is loaded from a server over a mobile telephone network.

Figure 3 shows schematically a system according to one more embodiment of the present invention. The system includes a mobile terminal 10 and an expansion module 60, which has been connected to an interface device 20 designed on the mobile terminal. The in Figure 2 shown connection points 90' respective 90" associated with the expansion module have been connected to the corresponding connection points 40' respective 40" of the mobile terminal shown in Figure 1, by connection of the interface 95 of the expansion module to the interface device 20 of the mobile terminal.

According to what has previously been described, the combination of the expansion module and the mobile terminal has resulted in that the address and data buses 40 of the mobile terminal now are directly connected to the processor 70 and memory 80 of the expansion module. The hardware platform of the mobile terminal consequently has been extended with these two said resources to at that make possible execution of capacity demanding applications or application environments on the expanded mobile terminal.

The connection of the expansion module 60 has resulted in that one in advance stored interruption routine in the mobile telephone has initiated reading of in the PROM-memory 81 in advance stored configuration data, which data are used to configure the address space for the resources of the mobile terminal, which by connection of the expansion module has been expanded, and for controlling of the switch 50. The interruption routine also has attended to that the in the PROM-memory in advance stored initiating routine has been called, at which this routine has resulted in calling a server over the mobile telephone network, followed by loading and storing of application software in the RAM-memory 82.

Concerning the elements which have been described with reference to the enclosed drawings, their construction and function, in addition to what has already been described and in addition to what is apparent from these drawings, 5 are obvious to the expert in the field.

Even though the invention above has been described with reference with reference to specific exemplified embodiments, it is to the expert evident that a lot of variants and modifications of these embodiments can be 10 achieved by within the frame of the scope of protection of the invention as it is defined in the enclosed patent claims.

## PATENT CLAIMS

1. System to increase the capacity of a mobile terminal to execute user applications or handle execution environments for user applications,  
5 c h a r a c t e r i s e d i n t h a t

a mobile terminal 10 includes at least one interface device 20 designed for reception of an expansion module 60; and

10 an expansion module 60 including at least one data storing component 80, at which said expansion module also includes an interface 95 designed for connection to said interface device 20 by which the mobile terminal and the expansion module form a common hardware platform.

15

2. System as claimed in patent claim 1, c h a r a c t e r i s e d i n t h a t said expansion module via said interface device is connected to the internal communication paths 40, of the mobile terminal, for address  
20 and data signals.

3. System as claimed in any of the patent claims 1 or 2, c h a r a c t e r i s e d i n t h a t said data storing component includes in advance stored data which constitute  
25 at least a part of a user application.

4. System as claimed in any of the preceding patent claims, c h a r a c t e r i s e d i n t h a t the data storing component is controlled and accessed via said internal  
30 communication paths.

5. System as claimed in any of the preceding patent claims, c h a r a c t e r i s e d i n t h a t said expansion module further includes at least one data processing  
35 component 70.

6. System as claimed in patent claim 5,  
c h a r a c t e r i s e d in that the data processing  
component controls and accesses components in at least one  
of the two of said mobile terminal or said expansion module  
5 via said internal communication paths.

7. System as claimed in patent claim 6,  
c h a r a c t e r i s e d in that said data processing  
component consists of a dedicated Java-processor.

10

8. System as claimed in any of the patent claims 6 or  
7, c h a r a c t e r i s e d in that said controlled and  
accessed components at least include one of the following:  
a component for storing of data included in said mobile  
15 terminal; a component for storing of data included in said  
expansion module; a communication port included in said  
mobile terminal; or a display included in said mobile  
terminal.

20 9. Expansion module 60 intended to increase the  
capacity of a mobile terminal to execute user applications  
or handle execution environments for user applications, at  
which said expansion module is  
c h a r a c t e r i s e d in that it includes:

25 at least one of the two of a data storing component 80  
or a data processing component 70; and

an interface 95 designed for connection to a mobile  
terminal, by means of which the module at connection to  
this expands the hardware platform of terminal.

30

10. Expansion module as claimed in patent claim 9,  
c h a r a c t e r i s e d in that said interface is  
designed for connection to the internal communication  
paths, of said mobile terminal, for address and data  
35 signals.



11. Expansion module as claimed in any of the patent claims 9 or 10, characterised in that the data storing component includes in advance stored data which constitute at least a part of a user application.

5

12. Expansion module as claimed in any of the patent claims 9-11, characterised in that the data storing component is controlled and accessed via said internal communication paths.

10

13. Expansion module as claimed in any of the patent claims 9-12, characterised in that the data processing component controls and accesses components in at least one of the two of said mobile terminal or said expansion module via said internal communication paths.

15

14. Expansion module as claimed in any of the patent claims 9-13, characterised in that said data processing component consist of a dedicated Java-processor.

20

15. Expansion module as claimed in any of the patent claims 9-14, characterised in that said controlled and accessed components at least include one of the following: a component for storing of data included in said mobile terminal; a component for storing of data included in said expansion module; a communication port included in said mobile terminal; or a display included in said mobile terminal.

25

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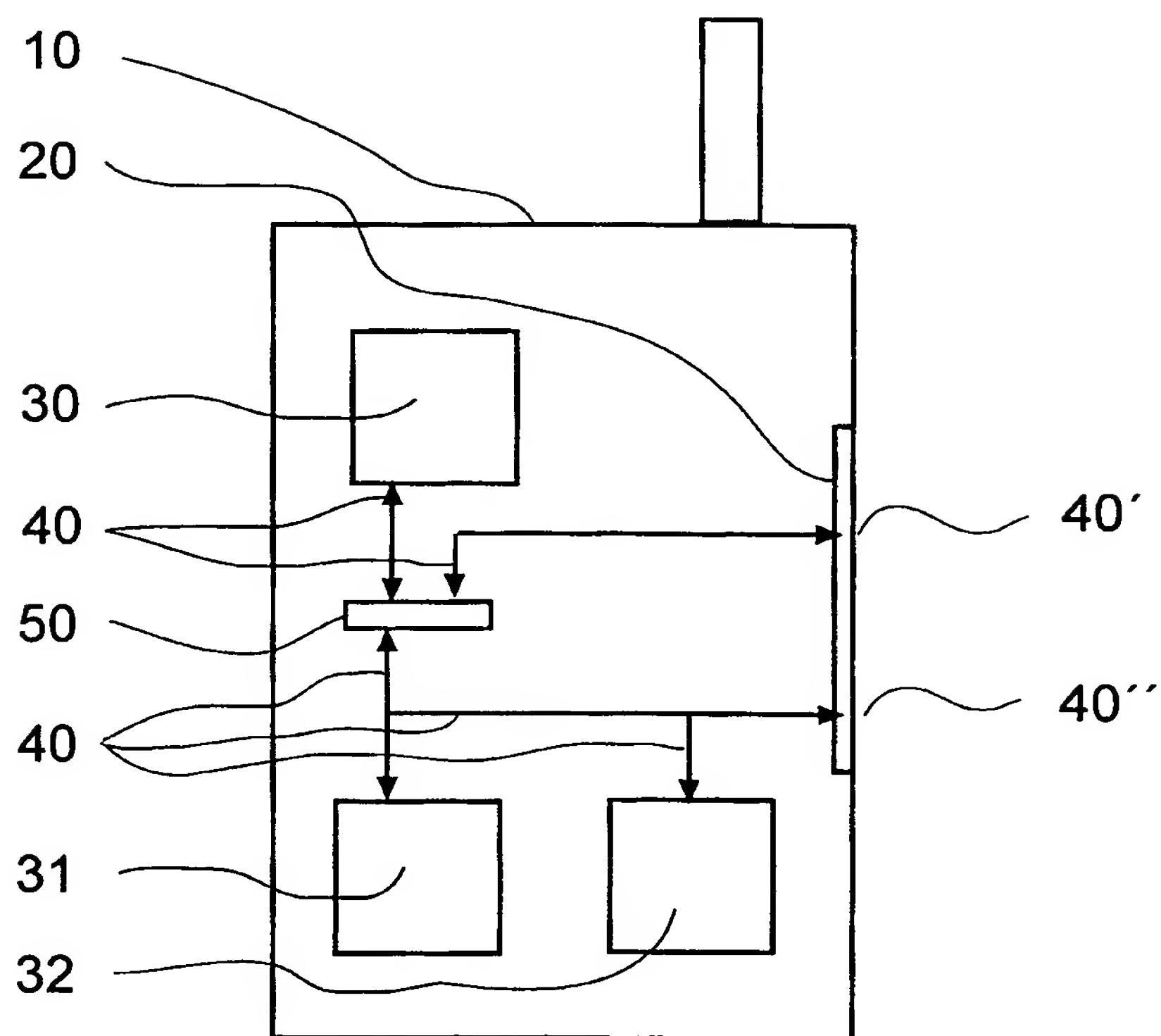


Fig.1

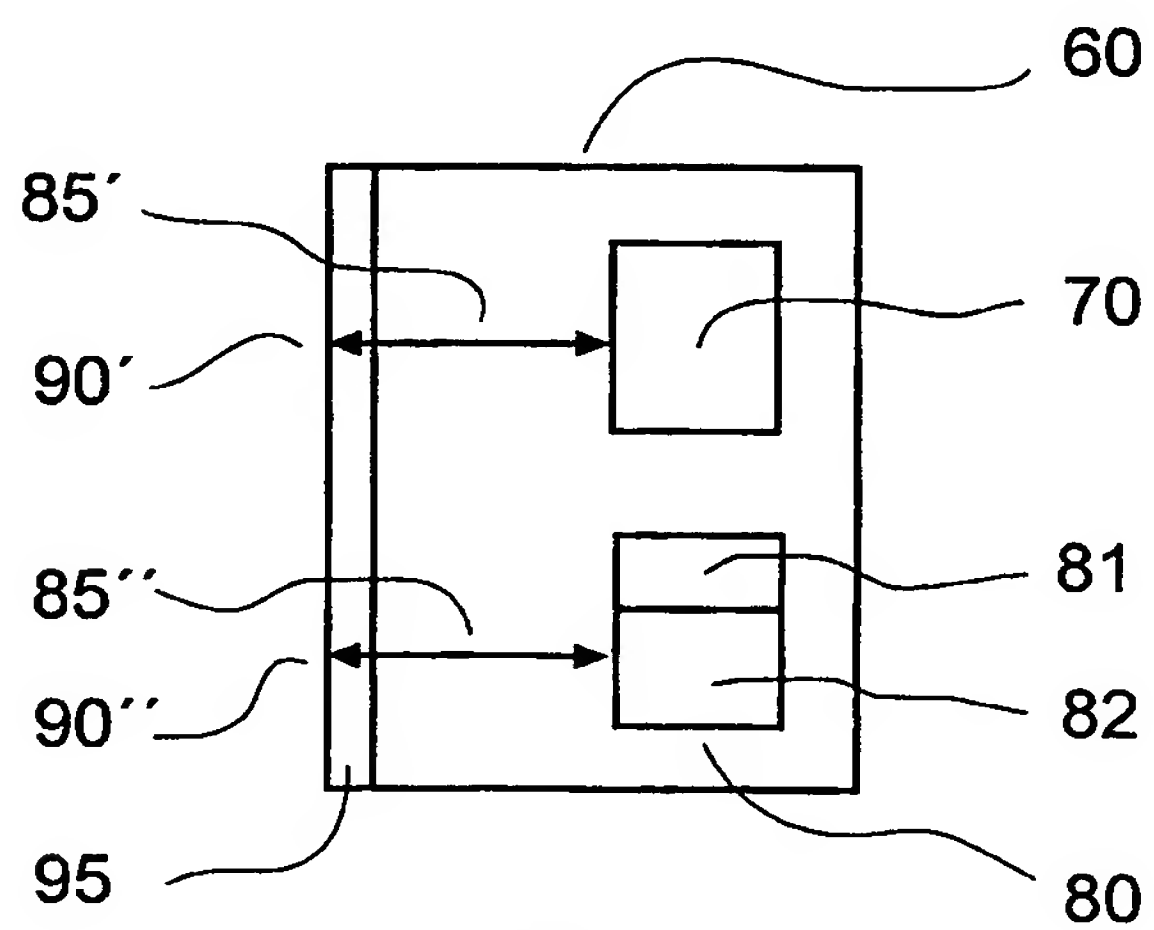


Fig.2

2/2

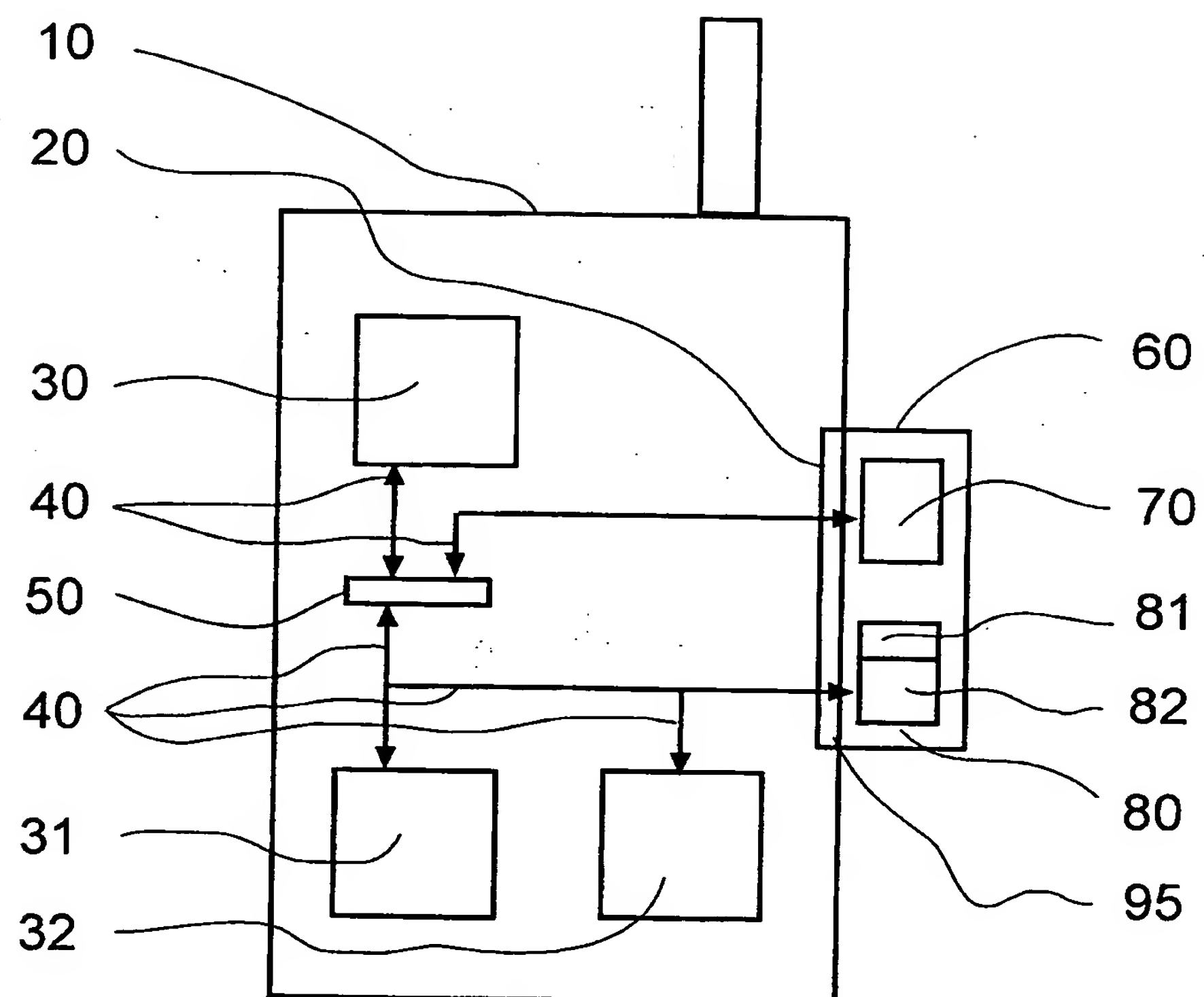


Fig. 3

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 99/01158

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04M 1/00

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## B. FIELDS SEARCHED

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5465401 A (E. EARLE THOMPSON), 7 November 1995 (07.11.95), column 2, line 52 - column 18, line 9, figures 7-8,10  --	1-15
X	US 5335276 A (E. EARLE THOMPSON ET AL), 2 August 1994 (02.08.94), column 2, line 54 - column 12, line 4, figures 7-8,10  -- -----	1-15

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Information on patent family members

28/09/99

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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US 5335276 A	02/08/94	NONE	

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